

**EFFECTS OF IMPROVISED PHASES OF MITOSIS ON BIOLOGY STUDENTS
ACHIEVEMENT AND RETENTION AMONG SECONDARY SCHOOL STUDENTS IN
MINNA METROPOLIS.**

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2014/1/51496BE

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ABSTRACT

The study examined the effects of improvised phases of mitosis on Biology students achievement and retention among secondary school students in Minna metropolis. The research design adopted for the study is pretest, posttest experimental and control group design. Senior secondary two (SS2) students in public schools in Bosso L.G.A of Niger state were captured for the study. Eight five student participated in the study, and were randomly selected from the Two sampled schools. The instrument used for data collection was a researcher made Biology Achievement Test (BAT). The questions were 20 objective item type with four optional answers (A-D) with only one right answer. The instrument were validated by experts in Biology education. Reliability test was also carried out and $r=0.75$ was obtained. Four research question and four null hypotheses were formulated to guide the study. The null hypotheses were tested at 0.05 level of significance. Out of the four null hypotheses formulated, two were accepted, while the other two were rejected. Statistical package for social science (23.00 version) was used to analyze the data obtained. The result of the study showed among others a significant difference in academic achievement and retention between the experimental and control groups in favor of the experimental group. Gender has no significant effect on students` achievement. It was recommended that Biology teachers should try to demonstrate instructional strategy and encourage students to do the same, this will give students enough understanding of Biology concept as the child`s local environment will be use to source for the materials in teaching Biology to enhance student achievement and retention.

KEY WORDS: Achievement, Biology, Improvisation, Instructional Materials, Mitosis, Students, Retention.

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CHAPTER ONE

1.0

INTRODUCTION

1.1 Background to the Study

The future of every nation including Nigeria lies in the quality of education given to the citizenry. For every developing nation to attain and sustain national development, a well planned and implemented science education remains an essential tool for her national development (Umoru, 2016). Science is therefore part of every education endeavour as it explains the existence of living things, our environment and how to improve on the way of living. Sheldon (2011) define science as an intellectual activity designed by humans to discover information about the natural world in which humans live to discover the ways this information can be organized into meaningful patterns. Science comprises of basic disciplines, they include Chemistry, Physics, Mathematics and Biology.

Biology is a science that deals with the study of life (Living things). According to Sarigin (2010) Biology is a fascinating study that ranges from microscopic cellular molecules to the biosphere, encompassing the earth surface and it`s living organisms. Biology is introduced to student at senior secondary school level as a preparatory ground for human development, where career abilities are groomed and potentials and talents discovered and energized (FRN, 2009). Biology is very important for national development and a perquisite to the study of some professional courses such as medicine, pharmacy etc. The field of Biology is broad in scope and can be broken down further into several specialized sub-disciplines which include; Anatomy, Cell- biology, Genetics, Physiology, Ecology, Evolution just to mention a few.

Cell is the structural and functional unit of life. The lifespan of a cell entails of two periods from the time a cell is form to the time it undergoes cell division. There are: Interphase and cell division. Cell division terminates the life of the cell but often results in the formation of daughter cells. Based on the behaviour of chromosome two type of cell division are recognized which are Mitotic cell division and Meiotic cell division. The concept of Mitosis is a topic in biology at senior schools level in Nigeria which can be taught using instructional materials. Mitosis is a process ubiquitous to life and a foundational topic necessary for the understanding of advance topics like growth and development, reproduction, and many disease processes. In spite of the importance and popularity of biology among Nigerian student, performance at Senior Secondary Certificate examination (SSCE) has been poor Judging from the chief examiner of West African Examination Council (WAEC) yearly report (2009- 2014).

Poor teaching method adopted by teachers at senior secondary level in Nigeria have been identified as one of the major factors contributing to poor performance of student in biology (Olumorin, 2004 and Ahmed, 2010). According to Balogun (2008) the poor achievement of Biology students was traced to poor usage of instructional material for biology teaching and learning, poor state of infrastructural facilities, large class size, poor teaching strategies, use of faulty assessment practice and inadequacy of quality teachers. In this study, instructional materials is the main focus in order to unveil their effects on the academic performance of students. The importance of instructional material cannot be over emphasized. This is for the fact that instructional materials enhance, facilitates and make teaching/ learning lively and concrete. Instructional material are those channels of communication which promote the effectiveness of instruction and help the teacher to

communicate ideas effectively to his student Ali (2012). Instructional materials include all the substantial resources that an educator might use to implement instruction which facilitates students' achievement and retention of knowledge. It should note that no lesson can be effectively taught without the use of instructional material Olumorin, Ajidagba, Jekayinfa and Yusuf (2010).

But unfortunately the Nigerian economy at present does not warrant the provision of all that the school system needs. This informed the idea of making and using available local resource for the shortfall to ensure that teaching and learning progress simultaneously without hinges. The available local resource in the absence of the original resource is referred to as improvisation. Studies on the achievement and retention of biology students in secondary schools shows that the use of instructional materials help students retain information for longer periods as compared to the conventional teaching method (Awolaju, 2015). Achievement is the measures of accomplishment in a specific field of study (Musa & Agwagah 2006), The authors maintained that achievement of the student is the demonstration of the ability to attain certain levels of instructional objectives. According to Akubuilu (2004) retention is an ability to recall or recognized what has been learned or experienced. Olagunju (2008) found that students taught reproduction in biology with constructive strategy performed better than those taught using conventional method. It was also reported to be gender friendly. Gender is a term used to describe an individual as either a male or a female. Studies by Ogunleye and Babajide (2011) shows no significant effects of gender in science. Others discovered that gender influence students achievement in science like Eze (2012), Adeyemi and Olaleye (2010) in favour of female student and also Fabe (2007) in favour of male student. From the foregoing statement it can be agreed that

instructional materials is an essential tool towards improving learning outcome and gender disparity in education is inconclusive.

1.2 Statement of the Research Problem

The main goal of teaching and learning is to bring about the desired behavioural change in learning. Given the high value of Biology in the Nigerian secondary school curriculum, the need to teach it effectively through an effective method is indispensable. Research studies have shown that there is an increase in enrolment of students in biology yearly. Lawal (2014) stated that the performance of students in the West African Senior Certificate Examination (WASSCE) is not encouraging. Failure in biology may result into shortage of health care personals both in terms of quality and quantity.

Many reasons have been advanced for the poor performance of learners. Which include, inadequate instructional material, lack of qualified teachers, method of teaching among others. Instructional materials play a key role towards concretizing learning. Instructional materials make learning meaningful and help to improve students' academic achievement. However these advantages of instructional materials have not reflected in the education system because of the shortage of these instructional materials in our schools. Hence, the need for improvised instructional materials. The use of appropriate instructional materials in teaching mitosis in biology becomes demanding. It is against this backdrop that this study is aimed at finding out the effect of using available material from the environment to built the stages of mitosis and straw tape DNA helix model in teaching mitosis. Therefore, the study intends to examine the effects of improvised phases of mitosis on Biology students achievement and retention in Minna Metropolis.

1.3 Aim and Objectives of the Study

The aim of the study is to determine the effects of improvised phases of mitosis on Biology students achievement and retention among secondary school students in minna metropolis.

While the specific objectives to be achieved include to;

1. Determine the mean achievement of students taught Biology with improvised phases of mitosis and those taught with lecture method.
2. Identify the gender influence on the mean achievement of students taught Biology with improvised phases of mitosis.
3. Determine the mean retention of students taught Biology with improvised phases of Mitosis and those taught with lecture method.
4. Find out the gender influence on the mean retention of students taught biology with improvised phases of mitosis.

1.4 Research Questions

The following research questions were raised to guide the study

1. Does the improvised instructional materials enhances secondary school Biology students` achievement scores on the concept of mitosis in Minna metropolis of Niger state?
2. Does the improvised instructional materials enhances secondary school Biology students` achievement scores on the concept of mitosis based on gender?
3. Does the improvised instructional materials enhances secondary school Biology students` retention scores on the concept of mitosis in Minna metropolis of Niger state?

4. Does the improvised instructional materials enhances secondary school Biology students` retention scores on the concept of mitosis based on gender?

1.5 Research hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significant,

HO₁: There is no significant difference in the mean achievement score of students taught Mitosis with improvised instructional materials and those taught with lecture method.

HO₂: There is no significant different in the mean achievement score of students` taught mitosis with improvised instructional materials based on gender.

HO₃: There is no significant difference in the mean retention scores of students taught mitosis with improvised instructional materials and those taught with lecture method.

HO₄: There is no significant difference in the mean retention scores of students taught mitosis with improvised instructional materials based on gender.

1.6 Significant of the study

The findings from this research work would be beneficial to student, teachers, Curriculum planners, school authorities and researchers.

To the Student: The effective use of instructional materials would enable them to effectively learn and retain what they have learnt and thereby advancing their performance in the subject in question, and also arouse interest in learning. According to AbdulRahman (2016) learning is a process through which knowledge, skills, habits, facts, ideas and

principles are acquired, retain and utilized, and this can be achieved through the effective use of instructional materials.

To the Teachers; They will be better informed on how to help and guide their students on better way of producing instructional materials. Biology teachers would think ahead of the topics they are to teach their students to maximize their gain, more than ever before, as it would enhance teachers teaching effectiveness and productivity This is in line with the assertion of Onasanya and Adebimpe (2008), who noted that it is only the teacher who will guarantee effective and adequate usage of instructional materials and thereby facilitates success.

To the Curriculum Planners; This study will broaden the knowledge and understanding with regard to the advantage and effectiveness of instructional materials, which will enable them formulate biology curriculum that is well rooted in the use of instructional materials in teaching and learning environment.

To the School Authority; The study will broaden the knowledge and understanding of with regard to the advantage and effect of instructional materials, which will enable them encourage and help teachers to produce improvise instructional materials. This may be in form of sourcing local materials and providing fund for those that cannot be found in the environment.

Researchers: The result of this study may also serve as a reference materials for future researchers, writers, students and professionals conducting research especially researchers in the area of science.

To the society at large; When a teacher solidifies their teaching with instructional materials and the learners learn effectively the knowledge acquired will reflect in the society positively.

1.7 Scope of the study

This study is on the effects of improvised phases of mitosis on Biology achievement and retention among secondary school students in Minna metropolis. This study will be conducted with SS2 Biology students in some selected secondary schools in Bosso L.G.A Minna, Niger state. The class SS2 will be used for the study because the topic to be taught is from their syllabus. The variables of this study were independent variable: use of instructional material, dependent variables: achievement and retention, moderating variable; gender. The study lasted for about 11 weeks.

1.8 Basic Assumption of the study

The basic assumptions of the study are:

1. The topic mitosis will not have been taught as at the time of the study.
2. The teacher would have not used the same type of improvised instructional materials in teaching the concept mitosis.
3. The learning conditions were also the same in both locations.

1.9 Operational Definition of terms

Effect: This can be described as the outcome of something or someone due to the action of a person or thing which causes changes.

Instructional materials - Also known as Teaching aid, are substantial resource that a teacher might use in teaching and learning situations to improve student achievement and retention of the concepts learnt.

Improvisation - Is the local production of instructional material as alternatives to actual materials either due to logistic or economic reasons.

Chromosome - A structure in all living cells that carry the genes which determine the character of every organism.

Mitosis- This is a type of cell division, which takes place during plant and animal's growth at the end of which the chromosome number of parent and daughter cells are equal.

Achievement- Students` score at post test

Retention- Ability to recall a piece of knowledge or information after some period of time, or students` scores at retention test (post- posttest).

Gender- Is a term used to describe an individual as male or female.

Learning outcome -Students` achievement and retention scores.

CHAPTER TWO

2.0 LITERATURE REVIEW

The review of related literature have been classified under the following sub headings; Conceptual Framework, Theoretical Framework, Empirical Framework, and Summary of the Literatures Reviewed.

2.1 Conceptual Framework

2.1.1 Teaching of Biology in Secondary Schools

Biology is a science that deals with the study of life (living things). Biology simply means the study of life. Biology as a natural science subject deals with contents from microscopic organisms to the biosphere in general, encompassing the earth`s surface and all living things (Okwo and Iliya, 2004). it is today viewed as a standard subject of instruction at all levels of our educational system. Biology is a core subject offered by science student in senior secondary school Nigeria. It is one of the major sciences whose teaching and learning is known to be effective with the aid of adequate instructional material such as model, diagram, charts etc. Araoye, (2009) opined that exposure to Biology education offers the learners a wide range of relevance to all aspect of life. Despite the fact that Biology is the simplest to comprehend among the science subjects, the level of academic achievement is nevertheless not much different from other science subjects among the students. In spite of the popularity of Biology among students, the failure rate has remained very high (Akubuilu 2004).

It is today`s demand to teach biology with a solid understanding of the most important scientific ideas by using new methods. Biology remains one of the basic sciences whose

teaching and learning is universally known to be successful, if only undertaken simultaneously with the help of adequate and relevant instructional Materials. Biology is important and stands as a bedrock to the studies of some professional courses such as Biochemistry, Medicine, Physiology, Ecology, Genetics, and Molecular Biology and as such, biology has been made a central focus in most human activities including being a solution to the problem of food scarcity, health, hygiene, family life, poverty eradication, management and conservation of natural resources, (Nwagbo, 2009). Based on these affirmations on the importance of biology, there is need for it to be properly taught in secondary schools to improve students' achievement in the subject.

2.1.2 Instructional Material for Teaching of Biology

The teaching and learning of all science subjects in general and Biology in particular require the use of instructional material.

Onasanya and Adebimpe (2008), describe instructional materials as channels of communication which promote the effectiveness of instruction and help the teacher to communicate ideas effectively to his student. Instructional materials are those resources used to improve teaching. Nigerian Educational Research and Development Council (2009) stated that it becomes necessary that a teacher should utilize all types of machinery in guiding students' learning and these machineries that can be used to guide learning are called instructional materials or teaching aids.

Instructional material includes all the available resources that an educator might use to implement instruction which facilitates students' achievement and retention of knowledge. They are aimed at grasping student attention, arousing their interest, supporting their learning

which makes classroom learning enjoyable (Isola, 2010). It has the ability to attract and hold attention, eliminate boredom. In a situation where real objects are not accessibly models can be developed and used to demonstrate the phenomenon. The use of instructional materials in teaching Biology is very important because it provides a concrete basis for conceptual thinking, which motivates pupils to learn more (Ajagn, 2006).

However, a common goal a teacher carrier wherever he is, is to make lesson presentation virtually fresh and stimulating for the students. This goal can be reached most efficiently through the use of instructional materials. For a biology teacher, these instructional materials are indispensable tools in his/her hands for the achievement and retention of the objectives of teaching. These materials may include simple familiar objects that can be locally obtained (Adeyemi and Olaleye, 2010). the importance of instructional materials for teaching and learning processes is to provide the teacher with the means of expanding the horizon of experience of students. This ensures students participation in the lesson, which promotes effective learning Adetayo (2008) is presumed that available and proper utilization of instructional materials improved the performance and retention of students. The new science curriculum used in Nigerian schools is activity- based and emphasizes the acquisition of productive skills for life- long learning. These require creativity on the part of the teacher in sourcing for and using appropriate instructional materials for teaching and learning (NPE, 2004). Instructional materials make learning process easier, which is why teacher should use it for better learning.

The importance of instructional material cannot be over emphasized. (Afolabi, Adeyanju, Adedapo Falade, 2006) opined that science teaching can only be effective when adequate and relevant instructional materials are used.

2.1.3 Improvisation of Biology Teaching Materials

Improvisation means to make or do something using whatever is available, usually because you don't have what you really need. Improvisation is the provision of alternatives to all things. These improvised instruments could be Produced by the teacher and the student. As, Adetayo (2008) rightly but it local production of material may also mean improvisation. Local production of educational resource can be viewed as substituting, or replacing the original material for a particular use in teaching. Olagunju (2008) define improvisation in terms of Biology as the process of using alternatives resources for enhancing biology teaching in the absence or shortage of real or manufactured ones. , for a teacher, skills for model construction can be acquired by first having adequate observational view of the real objects to get familiar with the forms and features of the object.

According to Usman (2003), the major reason for improvisation stems from the fact that educational funding is insufficient and in the recent years seriously dwindling. Educational authorities find it increasingly difficult to provide the schools with all they need for teaching and learning. There is need for improvisation of non-available instructional materials for students to get first-hand information and acquire the scientific skills as the objective stipulated.

According to Afolabi, Adeyanju, Adedapo, Falade (2006), Improvisation reduces the money spent on the purchase of equipment in educational institutes, gives room for a teacher to demonstrate his creative skills and the use of cheap local materials as alternative to the foreign ones. Improvisation is an activity embarked upon by a teacher to address

problems of the scarcity of instructional materials for the purpose of teaching and learning either due to logistic or economic reason. Students may also be involved by acquiring the materials from the environment. In case of teaching DNA where model is expensive, the teacher may improvise by using four different coloured straws to form the four nitrogenous bases. Olagunju (2008) opined that when a teacher improvises, it enables him to rethink and search for better, cheaper and faster methods of making the learning process easy and safe for both students and teacher.

2.1.4 Science Teaching Method

Teaching is a concept central to education and any academic setting. Nzeribe (2002) defined teaching as a conscious effort by an experience person to impart information, knowledge, skill, to a less experience person, with the intention that the later will learn what is taught. Teaching is a process of impacting knowledge. To Sawa (2002) teaching and learning are considered as two side of a coin, because teaching is meaningless without learning.

A teaching method comprises the ways or techniques used by a teacher to enable student learning. These methods are determining partly on the subject matter to be taught and partly by the nature of the learner. Abdullahi (2007) and Musa and Agwagah (2006), were of the view that methods employed by science teachers for teaching science in schools are unsuitable. They pointed out that most science teachers put more emphasis on theoretical aspects rather than practical aspects of science and most science teachers lack mastery of their subject matter. Ayodele (2006) supported this view when he identified a major factor that lowers students' achievement in science subjects to be lack of appropriate and

effective methodology of science teaching. Akinleye (2010) attested that effective teaching and learning requires a teacher to teach the students with instructional materials and use practical activities to make learning more vivid, logical and realistic. Esu (2004) agreed that instructional materials are indispensable to the effective teaching and learning activities. Usman and Adewunu (2006) also supported that teaching aids are always useful in supporting achievement and retention of students. Research results (Ajagn, 2012) have shown that biology teachers continue to teach using the lecture method despite the recommended guided discovery/ inquiry methods. The inability of biology teachers to apply guided inquiry/ discovery approach and other modern methods of science teaching , might be hinged on some problems which include poor performance and retention of students.

According to Adeyemi and Olaleye (2010), there is no single method for the teaching of science. The teaching method often used for science include traditional lecture method, guide inquiry method, problem solving method, demonstration method, laboratory method, discussion method.

This teaching methods are grouped by some educators Obiaho (2005) and Campbell (2006) into two approaches. The teacher centered approach and student centered approach.

2.1.5 Teacher Centered Approach

Teacher centered approach includes all the teaching methods that the teacher dominates in the lesson procedure. According to Balogun (2008) and Guisti (2008) the teacher centered approach of instruction often referred to as traditional method or talk and chalk method of teaching, where the teacher present fact orally and instructional materials are hardly used.

Teacher centered methods are direct instruction and includes all method grounded in behaviourism such as lecture or expository method, recitation and demonstration. Ibe (2004), noted that the traditional teaching methods stress transmission of knowledge in a manner that emphasize and encourage memorization, it encourages rote learning and does not recognized slow learners. Guisti (2008) describe the teacher centered approach as method that involve only unidirectional flow of information from the student to the teacher and those not encourage the use of instructional materials that make teaching active. The teacher as the authority figure does most of the talking while the student listen, write down note and ask few or no question. This method provides for the effective use of time, especially in presenting ideas to a large group of people.

2.1.6 Student Centered Method

The student are made the major focus of teaching and learning. According to Ajagn (2006), student cantered approach includes all innovative teaching method that are usually activity oriented. It includes all instructional method that view the teacher as a facilitator, /mentor as the learner construct their own understanding. Educational Broadcasting Corporation (2004) noted that the principles of student centred approach are linked to the philosophy of Rousseau work Emile which stressed on the innate nature of children to investigation and learning naturally from the environment experience. Adeyemi and Olaleye (2010) and Nwagbo (2006) view this type of teaching method as an environment which make learning more meaningful and last long as student are more actively involved.

2.1.7 Academic Achievement in Biology

Academic achievement is the outcome of education, the extent to which a student, teacher or institution has attained their educational goal. Schools are commonly evaluated using students' achievement (Nwagbo, 2006). Academic achievement is usually measured by examination. Adetayo (2001), found that there is a strong positive link between instructional resources and academic performance. Schools that possess more instructional resources perform better than the schools that have less instructional resources. Results from the WAEC examination in Biology (2009-2014), shows that majority of the students get grade with the range of D7 – F9, which indicate poor achievement.

Instructional materials are indispensable to the effective teaching and learning activities (Umoren, 2004). Fape (2007) also supported that teaching aids are always useful in supporting the sense organs. Despite the fact that instructional materials are essential tools that can make learning practical and knowledge acquisition easier, they are not readily available in Nigerian secondary schools leading to low level of performance of learners in examinations (Abdu-Raheem, 2016). Rothstein (2000) argues that learning is not only a product of formal schooling but also of communities, families and peers. Socio-economic and socio-cultural forces can affect learning and thus school achievement. Ahmed (2010) stated that there are two broad groups of definitions of academic achievement. The first one could be considered more objective, because it refers to numerical scores of a student's knowledge, which measure the degree of a student's adaptation to schoolwork and to the educational system.

The second group is a more subjective one, as its determination of academic success is reliant upon the student's attitudes towards his academic achievement and himself, as well

as by the attitudes of significant others towards his/her success and him/herself In an effort to improve students' cognition and affective outcomes in biology and /or school achievement, educational psychologists and science educators have continued to search for variables (personal and environmental) that could be manipulated in favor of academic gains. This study focuses on the effect of students' produced improvised instructional materials on the academic achievement and retention of students.

2.1.8 Gender Academic Achievement and Retention

Gender issues and its effect in students' academic achievement and retention has persisted over the years with contradicting results and stands out as a controversial issue in science education due to varying report from different research. Eze (2012), Adeyemi and Olaleye (2010) are of the view that females perform better than males in science. The findings from Olagunju (2008) and Ogunleye (2011), noted that gender had no effects on academic achievement. The research work of Ibe (2004) and Fabe (2007), report that males perform better than females. Based on these controversies, this study will further investigate the influence of gender, Considering the findings of different people above, it is clear that there is not yet a consensus as to whether gender influences science achievement or not. Some are of the opinion that males are superior to females, while others are of the view that females are superior to male and others are neutral.

2.2 Theoretical Framework

Learning theories are an organized set of principles explaining how individuals acquire, retain, and recall knowledge. According to Graves (2003), leaning is a function of mind whether one is taught by another person or teaches himself. There are various theories of learning in education they include behaviourist theory of learning, cognitive theory of

learning, constructivism theory of learning and social theory of learning. The behaviourist looks at learning as an aspect of conditioning and advocate for a system of rewards and targets in education. New behaviours or changes in behaviours are acquired through associations between stimuli and response. The theory is that learning begins when a cue or stimulus from the environment is presented and the learner reacts to the stimulus with some type of response. The theory was first introduced by the American psychologist John B. Watson. According to Ayodele, (2002) the behaviourist considers the environment for learning to be the determining factor. Teachers use behaviourism when they reward or punish student behaviour.

The cognitive theory of learning is credited to educational psychologist Jean Piaget. Piaget theory of learning is focused on human cognitive development. Cognitive information processing is based on the thought process behind the behaviour. cognitive information process is used when the learner plays an active role in seeking ways to understand and process information that he or she receives and relate it to what is already known and stored within memory. Educators who embrace cognitive theory believe that definition of learning as a change in behaviour is too narrow and study the learner rather than their environment. The theory is based on the idea that humans process the information they receive rather than merely responding to stimuli. Cognitive learning theorists believe learning occurs through external processing of information. Unlike behaviourism, cognitive information processing is governed by an internal process rather than by external circumstance. The cognitive approach to learning theory pays more attention to what goes on inside the learner`s head and focuses on mental processes rather than observable behaviour. Thus learning is a change in knowledge which is stored in memory, and not just a change in

behaviour. According to Piaget, knowledge is the interaction between individual and the environment.

John Dewey theory encourages hands- on learning and states that it is impossible to procure knowledge without the use of objects that impress the mind. As a constructivist. Dewey believed that teachers/instructors are partner in the learning process whose guidance and assistance help learners to construct their learning. The obvious implication of Dewey theory in this study is that in the learning process, student must be engaged in meaningful activities that induce them to apply the concept they are trying to learn. Constructivism is based on the premise that we all construct our own perspective of the world, based on individual experiences and internal knowledge. Knowledge is constructed by the learner and since everyone has a different set of experiences and perceptions, learning is unique and different for each person.

The Cognitive Learning Theory (CLT) is about understanding how human mind works while people learn. It is based o the idea that people mentally process the information they receive, rather than simply responding to stimuli from their environment. Piaget believed knowledge is something that is actively constructed by learners based on their existing cognitive structures. The behaviourist approach only studies external observable behaviour that can objectively be measured. The theory is based on a stimulus and a person`s response to that stimulus. Behaviourist believe that internal behaviour cannot be studied because internal, mental processes cannot be observed and objectively measured. In other words, we cannot see what happens in a person mind so we cannot measure it. However, unlike behaviourism, the cognitive approach believes that internal mental processes can be scientifically studied. It focuses on the thought process behind the behaviour. Therefore, the

cognitive approach to learning pays more attention to what goes on inside the learner's head.

Social learning theory, theorized by Albert Bandura, posits that people learn from one another, via observation, imitation, and modelling. The theory is often been called a bridge between behaviourist and cognitive learning theories because it encompass attention, memory and motivation.

2.4 Empirical Studies

Several empirical studies have been carried out by some school of thought and researches have shown that charts, models, diagrams have played an important role in improving student achievement and retention. Olumorin, Yusuf, Ajidagba, and Jekayinfa (2010) revealed that teaching materials obtained from the student's environment assist student to comprehend and remember science better. Therefore, it enhance the student to develop and maintained interest in science, grasp and retain the topic taught, feel and have an idea that science is everywhere. The findings from a research conducted by Okwo and Iliya (2004), on effect of the position of diagrams and cognitive style in biology noted that learning is made more effective.

Awolaju (2011), also carried out a study on instructional materials as a correlation of students' academic performance in Biology in Osun state, Nigeria, By stratified and simple random sampling, 100 students (50% males, 50% female) were selected and a 30-item four option multiple choice Biology achievement test (BAT) was constructed and administered. He found that a significant difference existed between students' taught Biology using instructional materials and those taught using conventional method.

Also Adeyemi and Olayeye (2010) investigated the effect of student involvement in production of instructional material on their academic performance in Biology, they found that significant difference existed between students taught biology without instructional materials and those taught using locally produced instruments,

Oladejo, Olosunde Ojebisi and Isola (2011) carried out a study on instructional materials and students' academic achievement in physics. The study examined the effects of using standardized and improvised instructional materials on academic achievement of secondary school physics students in Oyo State, Nigeria. The research design adopted was quasi-experimental of the pretest-posttest non-randomized control group. Purposive sampling was used to obtain a sample of three co-educational secondary schools. Each school provided one S.S3 student for the study. Two instrument were used in the study, the physics Achievement Test (PAT) to measure students' achievement and Teachers Instructional Guide (TIG) to train the teachers in the experimental groups. Three hypotheses were formulated and tested at 0.05 level of significance. Data were analyzed using ANOVA and ANCOVA. The student taught with improvised instructional materials obtained the highest achievement score at post test ($F=74.94$), followed by those with standard instructional materials ($F=63.07$), while the control group score the lowest ($F=39.89$). The finding shows that there is significant difference in the achievement of students taught using improvised instructional materials, standard materials and conventional materials. It was deduced that the use of improvised materials enhanced students' achievement than the other two methods. The physics teachers were advised to be more resourceful in improvising instructional materials since it promotes and enhance effective teaching and learning process. Therefore, in the same vein a similar method like

could also improve the performance of students in Biology because the study related to the current study being using available object from the environment as instructional materials to teach and learn biology concept.

Olagunju (2008), in his study of strategies and utilization of improvised Biology instructional materials and student` achievement and attitude in Ekiti state in senior secondary school. From the result, it was revealed that students taught with instructional materials performed better than those taught without instructional materials. Therefore Olagunju maintained that, science teachers should be encourage to improvised instructional materials and to encourage students participation in supply and improvising materials in science education.

On a separate study Usman (2008), on enhancing the academic performance in integrated science using improvised instructional materials among student. This study was carried out on 107 students from zaria area of Kaduna state. Integrated science achievement test (ISAT) comprises of 20 multiple choice test items was used for data collection, the data obtained were analysed the result show significant different between student taught with the improvised instructional materials and those taught without instructional materials.

There has been debate on the controversial issue of gender disparity in biology. Considering the above findings, studies have been carryout to investigate the influence of gender Olagunju (2008), found that there is no significant difference between the performance of male and females. Contrary to the finding, Nwagbo (2006) noted that some teaching methods that involve student competition such as individual learning favours male

students while other teaching methods that encourages group work such as co-operative learning favours females more than male.

2.5 Summary of the Literatures Reviewed

In the literature reviewed, researchers have shown that various teaching methods are use in teaching science at secondary school level. Thus, the selection of suitable structural strategies will assist learners to effectively grab the subject matter.

Reviewed studies have shown that the use of instructional materials is very important for achievement and retention of concepts because it improves teaching and learning. Biology is a core subject offered by science students in secondary schools in Nigeria whose teaching is best known to be effective with appropriate instructional materials such as models, diagram, chart etc. it has been revealed that biology teaching is affected by inadequate or lack of instructional materials in Nigeria educational system. Therefore, in a situation of dearth of instructional materials, improvisation becomes inevitable for science teachers. Also student are involved to participating by following the required procedures.

Researches in science education have shown their concern on gender related issues. Several research conducted reveal that there is no significant difference in academic achievement and retention of male and female. Although few studies conducted by Okeke (2007), Adeyemi (2010) Ibe (2004), Fape (2007) are of the contrary opinion.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

This chapter presents the researchers plan on how this study was conducted under the following headings; Research Design, Population of Study, Sampling Techniques, Instrumentation, Validity of the Instrument, Reliability of the Instruments, Methods of Data Collection and Method of Data Analysis.

3.1 Research Design

The research design adopted for the study is Quasi-experimental design. Which involved pretest, post-test, experimental and control group. The choice of this design was because of the nature of the subject which do not lean themselves to complete randomization process, hence, intact classes were randomly assigned to experimental and control groups and generalization was made. The experimental group were provided with the improvised instructional materials needed to teach the selected topics, while the control group were taught the same topic without instructional materials (conventional method). A Biology achievement test was used to pre-test, post-test and retention test for both groups. The students` achievement and retention were considered as dependant variables while the conventional and the improvised instructional materials modes of teaching were independent variables.

Table 3.1 research design illustration.

Group	pretest	treatment	posttest	retention test
Experimental group	O_1	x_1	O_2	O_3
Control group	O_1	x_0	O_2	O_3

Key

Where

- O_1 = Pretest for both experimental and control groups
 O_2 = Posttest for both experimental and control groups
 O_3 = Retention test for both experimental and control groups
 X_1 = Treatment (improvised instructional material)
 X_0 = No treatment (no instructional material)

3.2 Population of the Study

The total population of biology student in Bosso Local Government Area Niger State is 3226, The target population is SS2 Biology student in Bosso LGA of Niger State. The student population consisted of 1425. The choice of SS2 student for the study was because the teachers topic (Mitosis) is in their syllabus and they are not preparing for any external examination. The sample size used for this study was 85 students. The students were drawn from intact classes of two co-educational schools in Bosso LGA of Niger State.

3.3 Sampling Techniques

Simple random sampling techniques was used to selection two co-educational secondary schools from Bosso LGA, Niger State, Nigeria. The schools were randomly assigned to experimental and control groups. According to Asika (2006), random sampling uses the

principle of randomization which is a procedure of giving every subject in a population an equal chance of appearing in the selection. The experimental group consist of 45 students taught with the used of improvised instructional materials and the control group consist of 40 students taught without improvised instructional materials.

Table 3.2: Population Distribution in Sampled Classes.

S/N	School	Male	Female	Total
1	Experimental Group			
	Bosso Secondary School Minna	24	21	45
2	Control Group			
	Sir Ahmadu Bello Secondary School Minna	22	18	40

3.4 Instrumentation

The instrument used for data collection for the study is Biology Achievement Test (BAT). The test instrument was developed by the researcher based on SS2 Biology curriculum on the concept of mitosis. The biology achievement test contain twenty (20) items, each item has four option (A-D) with only one right answer. The item were used for pretest, post-test and retention test, the item were reshuffle for retention test. In order to create an impression that the questions were different. Improvised straw tape DNA Helix model and stages of Mitosis chart, was made by the researcher and used as treatment instrument for the study. The use of researchers based instructional materials was based on the fact that commercially produced instructional material are too expensive and not readily available. Thus developing an instructional materials for this study was inevitable.

The questions standard were drawn from basic concept using Table of specification.

3.3 Table of specification on the six level of cognitive domain

Domain level	Knowledge	Comprehension	Analysis	Application	Synthesis	Evaluation	Total
MITOSIS	6	6	6	1	1	-	20

3.4.1 Validity of the Instrument

The face and content validity of the instrument prepared by the researcher was done by three experts in the field of Biology. The BAT items, Improvised Straw tape DNA and phases of Mitosis were also validated by three experts lecturers from science education department, Federal University of Technology Minna.

3.4.2 Reliability of the Instrument

The researcher used test-retest technique to determine the reliability of the test instrument. The test-retest was conducted in Day Secondary Schools, Maikunkele Minna which was not among the sampled schools used for this study. Fifteen students drawn randomly were given the test item to answer. The script were collected and marked. After a week, the questions were re administered to the students. The two scripts were collected and analyzed to estimate the reliability of the instrument using Pearson product moment correlation coefficient method. This yield an r- value 0.75, a coefficient considered to be reliable and having a good internal consistency.

3.5 Method of Data Collection

Based on pretest administered to the students, two groups, group A and group B comprising of 85 biology student were used for the study. The student under experimental group were taught with improvised instructional materials while the student under control group were taught with conventional teaching method (without instructional materials). At the end of

the teaching period Biology achievement test BAT contain twenty question item based on the content taught were administered to the students under thorough supervision. After two weeks post-test delayed was administered to determine the retention ability of the students in both experimental and control group.

Table 3.5: Weekly Description of Researchers Work

S/N	Week	Activity
1	Week 1	<ul style="list-style-type: none"> - The researcher visited selected schools and sought permission from the school to facilitate her research. -the school granted her request, subsequently she was introduced to the biology teacher. -we highlighted areas beneficial to the research and the purpose. - the researcher discussed her aims and goals, also mode of improving improvised instructional materials -the researcher was introduced to the students in the class
2	Week 2 & 3	<ul style="list-style-type: none"> - Student were grouped into experimental and control groups - Pretest questions were administered to the students with the help of the school biology teachers
3	Week 4 & 6	<ul style="list-style-type: none"> -the main test was carried out - the first group (experimental group were taught using improvised instructional materials, the second group (Control group) were taught using lecture method

- with the assistant of the teacher, the Experimental group were guided on the stages for constructing mitosis for retentive memory.

4	Week 7	Revision
5	Week 8	BAT was administered as posttest to measure the achievement of both groups
6	Week 9 & 10	Two weeks break
7	Week 11	BAT was reshuffled and administered as a retention test.

The score gotten from the test were subjected to data analysis based on the formulated hypotheses.

3.7.1 Method of Data Analysis

The data obtained from the study was analyzed using mean, standard deviation and t-test statistic for the pretest, post-test and retention scores using statistical package for social science (SPSS) 23.00 version. The mean and standard deviation were used for answering the research questions. The t-test of significance between two means was used, It reduces the experimental errors and so increases the probability of rejecting the Null hypothesis when it is false. The t-test statistics were used to test all the four hypotheses and $P < 0.05$ was the level of significance adopted for this analysis. It therefore, formed the basis of rejecting or retaining the null hypothesis.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter presents the analysis of data obtained after administration of achievement test and retention on research sample and various analysis was carried out using mean and standard deviation and t-test.

4.1 Results

Research Question One: Does the improvised instructional materials enhances secondary school biology students` achievement scores on the concept of mitosis in Minna metropolis of Niger state?

Table 4.1: Mean and Standard Deviation of Achievement Score of Secondary School Biology Students on the Concept of Mitosis

Variable	N	Mean (\bar{X})	SD	Remark
Experimental	45	70.22	10.44	
				Significant
Control	40	61.88	9.59	

Table 4.1 shows Mean achievement score and Standard Deviation of secondary school Biology students taught Mitosis using improvised instructional materials and those taught using conventional teaching method. From Table 4.1, it was observed that the Mean score of the two groups were different where Experimental Group had Mean achievement score of 70.22 with Standard Deviation of 10.44 and control group had Mean achievement score of 61.88 with Standard Deviation of 9.59. This revealed that improvised instructional materials improved students' achievement better than conventional teaching method.

Research Question Two: Dose the improvised instructional materials enhances secondary school biology students' achievement scores on the concept of mitosis based on gender?

Table 4.2: Mean and Standard Deviation of Achievement Score of Secondary School Biology Male and Female Students on the Concept of Mitosis

Variable	N	Mean (\bar{X})	SD	Remark
Males	24	66.65	10.73	Not significant
Females	21	67.05	10.98	

Table 4.2 shows Mean achievement score and Standard Deviation of secondary school Biology male and female students taught Mitosis using improvised instructional materials and those taught using conventional teaching method. From Table 4.2, it was observed that the Mean score of the two groups were different where male students had Mean achievement score of 66.65 with Standard Deviation of 10.73 and female students had Mean achievement score of 67.05 with Standard Deviation of 10.98. This revealed that improvised instructional materials improved female students' achievement better than male students.

Research Question Three: Does the improvised instructional materials enhances secondary school biology students' retention scores on the concept of mitosis in Minna metropolis of Niger state?

Table 4.3: Mean and Standard Deviation of Retention Score of Secondary School Biology Students on the Concept of Mitosis

Variable	N	Mean (\bar{X})	SD	Remark
Experimental	45	69.85	10.22	Significant
Control	40	53.88	6.25	

Table 4.3 shows Mean retention score and Standard Deviation of secondary school Biology students taught Mitosis using improvised instructional materials and those taught using conventional teaching method. From Table 4.3, it was observed that the Mean score of the two groups were different where Experimental Group had Mean retention score of 69.85 with Standard Deviation of 10.22 and control group had Mean retention score of 53.88 with Standard Deviation of 6.25. This revealed that improvised instructional materials improved students' retention better than conventional teaching method.

Research Question Four: Does the improvised instructional materials enhances secondary school biology students` retention scores on the concept of mitosis based on gender?

Table 4.4: Mean and Standard Deviation of Retention Score of Secondary School Biology Male and Female Students on the Concept of Mitosis

Variable	N	Mean (\bar{X})	SD	Remark
Male	24	62.59	10.41	Not significant
Female	21	63.00	10.99	

Table 4.4 shows Mean retention score and Standard Deviation of secondary school Biology male and female students taught Mitosis using improvised instructional materials and those

taught using conventional teaching method. From Table 4.4, it was observed that the Mean score of the two groups were different where male students had Mean retention score of 62.59 with Standard Deviation of 10.41 and female students had Mean retention score of 63.00 with Standard Deviation of 10.99. This revealed that improvised instructional materials improved female students' retention better than male students.

4.2 Testing of Hypotheses

H₀₁: There is no significant difference in the mean achievement score of students taught Mitosis with improvised instructional materials and those taught with lecture method.

Table 4.5: Summary of t-test Analysis of Mean Achievement Scores of Biology Students Taught with Improvised Instructional Materials and those Taught with Conventional Teaching Method

Group	Variable	N	Df	\bar{X}	SD	t-value	P-value
Pre-Test	Experimental	45	83	41.33	8.555	0.77	0.12 ^{NS}
	Control	40		43.25	8.590		
Post-Test	Experimental	45	83	70.22	10.44	0.89	0.00*
	Control	40		61.88	9.59		

* - Significant at 0.05,

NS-Not Significance at 0.05.

Table 4.5 shows the t-test analysis of pretest of experimental and control group (t-value =0.77, df=83, P-value >0.05) was not significant. This was why t-test was used to analyse the posttest of the experimental and control group and the outcome (t-value = 0.89, df=83, P-value <0.05) was significant, as such hypothesis one was rejected. This implies that using

Improvised Instructional Materials to teach students Mitosis in Biology improved their academic achievement compared to using only conventional teaching method.

H02: There is no significant different in the mean achievement score of students` taught mitosis with improvised instructional materials based on gender.

Table 4.6: Summary of t-test Analysis of Mean Achievement Scores of Biology Male and Female Students Taught with Improvised Instructional Materials

Group	Variable	N	Df	\bar{X}	SD	t-value	P-value
Post-Test	Male	24		66.65	10.98	0.82	0.56 ^{NS}
			43				
	Female	21		67.05	10.73		

NS-Not Significance at 0.05.

Table 4.6 shows the t-value was 0.82 and the P-value was 0.56, this means it was not significant as such hypothesis two was accepted. The mean score of the male group was 66.65 and standard deviation was 10.98 while the mean score of female was 67.05 and the standard deviation was 10.73. This implies that using Improvised Instructional Materials to teach students Mitosis in Biology have the same effects on both gender.

H03: There is no significant difference in the mean retention scores of students taught mitosis with improvised instructional materials and those taught with lecture method

Table 4.7: Summary of t-test Analysis of Mean Retention Scores of Biology Students Taught with Improvised Instructional Materials and those Taught with Conventional Teaching Method

Group	Variable	N	Df	\bar{X}	SD	t-value	P-value
Posttest	Experimental	45	83	70.22	10.41	0.89	0.00*
	Control	40		61.88	9.59		
Retention	Experimental	45	83	69.85	10.22	0.00	0.00*
	Control	40		53.88	6.25		

* - Significant at 0.05,

NS-Not Significance at 0.05.

Table 4.7 shows the t-test analysis of posttest of experimental and control group (t-value = 0.89, df=83, P-value <0.05) was significant. The retention of the experimental and control group and the outcome (t-value = 0.00, df=83, P-value <0.05) was significant, as such hypothesis three was rejected. This implies that using Improvised Instructional Materials to teach students Mitosis in Biology improved their retention level achievement compared to using only conventional teaching method.

H₀₄: There is no significant difference in the mean retention scores of students taught mitosis with improvised instructional materials based on gender.

Table 4.8: Summary of t-test Analysis of Mean Retention Scores of Biology Male and Female Students Taught with Improvised Instructional Materials

Group	Variable	N	Df	\bar{X}	SD	t-value	P-value
Retention	Male	24		62.59	10.41		
			43			0.53	0.40 ^{NS}
	Female	21		63.00	10.99		

NS-Not Significance at 0.05.

Table 4.8 shows the t-value was 0.53 and the P-value was 0.40, this means it was not significant as such hypothesis four was accepted. The mean score of the male group was 62.59 and standard deviation was 10.41 while the mean score of female was 63.00 and the standard deviation was 10.99. This implies that using Improvised Instructional Materials to teach students Mitosis in Biology have the same effects on both gender in terms of retention.

4.3 Summary of Findings

1. This revealed that improvised instructional materials improved students' achievement better than conventional teaching method.
2. This revealed that improvised instructional materials improved female students' achievement better than male students.
3. This revealed that improvised instructional materials improved students' retention better than conventional teaching method.
4. This revealed that improvised instructional materials improved female students' retention better than male students.

4.4 Discussion of Findings

This revealed that improvised instructional materials improved students' achievement better than conventional teaching method. There was statistically significant difference in the hypothesis. This finding was supported by the finding of Adeyemi and Olayeye (2010) who investigated the effect of student involvement in production of instructional material on their academic performance in Biology, he found that significant difference existed between students taught biology without instructional materials and those taught using locally produced instruments. Similarly, the finding is in agreement with the finding of Oladejo, Olosunde Ojebisi and Isola (2011) who carried out a study on instructional materials and students' academic achievement in physics and student taught with improvised instructional materials obtained the highest achievement score at posttest, followed by those with standard instructional materials, while the control group score the lowest. The finding shows that there is significant difference in the achievement of students taught using improvised instructional materials, standard materials and conventional method.

This revealed that improvised instructional materials improved female students' achievement better than male students but there was no significant difference between the two groups. This finding was supported by In terms of gender Ogunleye and Babajide (2011) who found that there is no significant difference between the performance of male and females. but, the finding was in dis agreement with the finding of Adeyemi and Olayeye (2010) based on gender who carried out a study on effect of student involvement in the production of instructional materials on their academic achievement in biology and

reported that significant difference in the post-test performance scores of male and female students taught biology using instructional materials.

This revealed that improvised instructional materials improved students' retention better than conventional teaching method. There was also significant difference in the hypothesis. This finding is in agreement with the finding of Isola (2010) who investigated the Effects of standardized and improvised instructional materials on academic achievement in Biology and discovered that there was significant difference between biology students who were taught with instructional materials and those taught without instructional material. It thus enhances students' retention. In a similar development, the finding was supported by Okwo and Illiya (2004) who carried out a study on effect of diagrams and cognitive style on Biology achievement and asserted that poor performance of student is due to poor retention and that using instructional materials to teach students may help in resolving problem in Biology by increasing students' retention.

This revealed that improvised instructional materials improved female students' retention better than male students. There was no significant difference in the hypothesis. This finding is in agreement with the finding of Usman (2003) who revealed that teaching materials obtained from the environment assist students to comprehend and remember science better. Therefore, it enhance the student to develop and maintained interest in science, grasp and retain topic taught. than their counterparts taught Biology using conventional method, and there was no significant difference reported in the retention scores of male and female students taught biology using instructional materials. The result is in dis agreement with the findings of Eze (2012) who noted that females retained Biology concept better than male.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

This chapter focuses on the Conclusion, Recommendation, Implication of the study, and Suggestion for further research work were also made.

5.1 Conclusion

It can be concluded based on the findings of this study that improvised instructional materials enhanced students' achievement and retention in Mitosis more than the use of conventional teaching method. Secondly, students taught Mitosis with the use of improvised instructional materials (experimental group) performed better than their counterpart taught same Mitosis using the conventional method. Female students achieved better than male students in the tests. There was no significant difference in gender achievement and there was also no significant difference in retention of male and female students taught Mitosis with improvised instructional materials but the female students retained the concept better than their male counterpart. Therefore, the use of improvised instructional materials improved the teaching and learning of Mitosis.

5.2 Recommendations

From the findings of this study, the following recommendations were made

1. The teacher should make use of different instructional materials as long as they are relevant to their content.
2. There is also need for the teachers to be resourceful in material selection and planning. this is to reduce the cost of production and maintenance of instructional materials.

3. Government should try to provide funds to secondary school biology teachers to enable them improvised instructional materials for teaching biology.
4. Stakeholders in education should organised in service training, seminar, workshops conference on the need and how to apply instructional materials and also curriculum that is well rooted in the use of instructional materials in teaching and learning environment.
5. Teachers should try to demonstrate instructional strategy and encourage students to do the same. This will give students enough understanding of biological concept as the child`s local environment will be use to source for the materials
6. Teachers generally and Biology teachers in particular should always improvised when the factory made instructional materials are not available to concretize their lesson to improve students` academic achievement and retention.
7. School management as a matter of being patriotic should provide funds so as to procure the materials necessary for improvisation of instructional materials in Biology that would facilitate the effective teaching of Biology.
8. Teachers and students should be further encouraged to form the habit of improvising instructional materials to make up for the shortfall in supply.

5.3 Implication of the Study

The results of this study have implications to the instructor since the teacher is made to know that using improvised instructional materials for teaching and learning is better than using the conventional method. Therefore, tutors should use this awareness from the findings of this study in their teachings particularly with the ease of use of local available materials in schools. Teachers should have the necessary skills to manipulate available

materials and use them during their lessons, so that they will be able to teach effectively without hindrance. Since improvised instructional materials has encouraging influence on the students' achievement and retention, from the results of this study, therefore all stakeholders in education sector should organize seminars and workshops to emphasize and train teachers on various ways of designing and developing improvised instructional materials for successful teaching and learning of Mitosis and other subject matter in biology. Students should also be encouraged to acquire relevant materials from their environment and use them to make instructional materials. The findings from this study call for a crucial re-examination of biology curriculum for both teachers training and student training with the aim of improving teaching and learning.

5.4 Suggestions for Further Research

Based on the experience gathered during the course of this study the following are suggested for future research on the use of improvised instructional materials in teaching and learning.

- i. Related study should be carried out to verify the influence of improvised instructional materials in other aspects of biology.
- ii. The study should not be limited to only senior secondary school students but it should be extended to primary school pupils, junior secondary school students and students in higher institutions in the prospective research.
- iii. Similar studies should be repeated in other subjects and states.

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APPENDIX A

PRE TEST QUESTION

INSTRUCTION: Answer the following questions by tick (√) /circle the correct answers from option A-D.

Sex: Male () Female()

(1.) The lifespan of a cell consist of_____ period from the time the cell is formed to the time it undergoes cell division.

(a) 3

(B) 4

(c) 2

(D) 5

(2.)_____ Terminate the life of a cell but often result in the formation of new cells?

(a) mitosis

(B) cell division

(C) DNA

(d) chromosome

(3.) The combine loop of DNA and protein is_____?

(a) histone

(b) nucleus

(C) nucleosome

(d) interphase

(4.) The end result of DNA packaging is called_____?

(a)Nucleus

(B) Chromosome

(C) Histone

(D) Protein

(5.) A cell enters into the cell cycle as 1 cell which exit as _____ cell

(a) 1

(b) 3

(c) 4

(d) 2

(6.) The somatic chromosome number of the organism is composed of two sets of chromosomes each set is termed as?

(a) Diploid(n)

(b) Diploid($2n$)

(c) Haploid(n)

(d) Diploid($2n$)

(7.) The somatic number of chromosomes in any normal sexually reproducing organism is also refer to as?

(a) Haploid(n)

(b) Diploid(n)

(c) Haploid($2n$)

(d) Diploid($2n$)

(8.) If a cell begins with 50 chromosome, after the completion of all the mitotic events, each of the new cell will have _____ chromosome?

(a) 25

(b) 50

(c) 100

(d) 200

(9.) Mitosis results in the formation of new cell called?

(a) Mother cell

(b) Father cell

(c) Brother cell

(d) Daughter cell

(10.) The life cycle of the cell begins at _____ stage ?

(a) Interphase

(b) Metaphase

(c) Anaphase

(d) Telophase

(11.) During which stage of Mitosis do the centromere split in to two half ?

(a) Telophase

(b) Interphase

(c) Anaphase

(d) Metaphase

(12.) The cell spends most of its time at _____ ?

(a) Anaphase

(b) Mitosis

(c) Metaphase

(d) Interphase

(13.) _____ Is the beginning stage of mitosis?

(a) Interphase

(b) Anaphase

(c) metaphase

(d) Prophase

(14.) During what stage of mitosis is the paired chromatids aligning in the center?

(a) Metaphase

(b)telophase

(c)anaphase

(d)prophase

(15.) What is the correct order of the stages in Mitosis 1-Metaphase, 2-Telophase, 3-Anaphase, 4-prophase?

(a.)4,1,2,3

(b)2,3,1,4

(c) 1,2,3,4

(d) 4,1,3,2

(16.) At mitosis nucleus disappear at _____ and re appear at _____ stage?

(a) Prophase, Telophase

(b) Metaphase, Telophase

(c) Prophase, Anaphase

(d) Metaphase, Prophase

(17.) mitosis is divided into_____ phase

(a)4

(b) 5

(c) 6

(d)7.

(18.) In Mitosis_____ and _____ have opposite process occurring ?

(a) Prophase and Telophase

(b) Metaphase and Anaphase

(c) prophase and metaphase

(d)Metaphase and Telophase

(19.) At what phase of mitosis do the parent cell divided into two identical daughter cell ?

- (a) prophase
- (b) Telophase
- (c) Metaphase
- (d) Anaphase

(20.) in Which of the following phase would you find DNA being replicated?

- (a) Interphase
- (b) Prophase
- (c) Metaphase
- (d) Telophase

PRE TEST ANSWER

- 1. C
- 2. B
- 3. C
- 4. B
- 5. D
- 6. A
- 7. D
- 8. B
- 9. D
- 10. A
- 11. C
- 12. D
- 13. D
- 14. A
- 15. D
- 16. B
- 17. A
- 18. A
- 19. B
- 20. D

APPENDIX B

POST TEST QUESTION

INSTRUCTION: Answer the following questions by tick (✓) /circle the correct answers from option A-D.

Sex: Male () Female()

- (1.) The somatic chromosome number of the organism is composed of two sets of chromosomes each set is termed as?
- (a) Diploid(n)
 - (b) Diploid(2n)
 - (c) Haploid(n)
 - (d) Diploid(2n)
- (2.) The somatic number of chromosomes in any normal sexually reproducing organism is also refer to as?
- (a) Haploid(n)
 - (b) Diploid(n)
 - (c) Haploid(2n)
 - (d) Diploid(2n)
- (3.) If a cell begins with 50 chromosome, after the completion of all the mitotic events, each of the new cell will have _____ chromosome?
- (a) 25
 - (b) 50
 - (c) 100
 - (d) 200
- (4.) Mitosis results in the formation of new cell called?
- (a) Mother cell
 - (b) Father cell
 - (c)Brother cell

(d) Daughter cell

(5.) The life cycle of the cell begins at _____ stage ?

(a) Interphase

(b) Metaphase

(c) Anaphase

(d) Telophase

(6.) During which stage of Mitosis do the centromere split in to two half ?

(a) Telophase

(b) Interphase

(c) Anaphase

(d) Metaphase

(7.) The lifespan of a cell consist of _____ period from the time the cell is formed to the time it undergoes cell division.

(a) 3

(B) 4

(c) 2

(D) 5

(8.) _____ Terminate the life of a cell but often result in the formation of new cells?

(a) mitosis

(B) cell division

(C) DNA

(d) chromosome

(9.) The combine loop of DNA and protein is _____?

(a) histone

(b) nucleus

(C) nucleosome

(d) interphase

(10.) The end result of DNA packaging is called_____?

(a)Nucleus

(B) Chromosome

(C) Histone

(D) Protein

(11.) A cell enters into the cell cycle as 1 cell which exit as _____ cell

(a) 1

(b) 3

(c) 4

(d) 2

(12.) At mitosis nucleus disappear at _____ and re appear at _____ stage?

(a) Prophase, Telophase

(b) Metaphase, Telophase

(c) Prophase, Anaphase

(d) Metaphase, Prophase

(13.) mitosis is divided into _____ phase

(a)4

(b) 5

(c) 6

(d)7.

(14.) In Mitosis _____ and _____ have opposite process occurring ?

(a) Prophase and Telophase

(b) Metaphase and Anaphase

(c) prophase and metaphase

(d) Metaphase and Telophase

(15.) At what phase of mitosis do the parent cell divided into two identical daughter cell ?

(a) prophase

(b) Telophase

(c) Metaphase

(d) Anaphase

(16.) in Which of the following phase would you find DNA being replicated?

(a) Interphase

(b) Prophase

(c) Metaphase

(d) Telophase

(17.) The cell spends most of its time at _____ ?

(a) Anaphase

(b) Mitosis

(c) Metaphase

(d) Interphase

(18.) _____ Is the beginning stage of mitosis?

(a) Interphase

(b) Anaphase

(c) metaphase

(d) Prophase

(19.) During what stage of mitosis is the paired chromatids aligning in the center?

(a) Metaphase

(b) telophase

(c)anaphase

(d)prophase

(20.) What is the correct order of the stages in Mitosis 1-Metaphase, 2-Telophase, 3-Anaphase, 4-prophase?

(a.)4,1,2,3

(b)2,3,1,4

(c) 1,2,3,4

(d) 4,1,3,2

POST TEST ANSWER

1. A

2. D

3. B

4. D

5. A

6. C

7. C

8. B

9. C

10. B

11. D

12. B

13. A

14. A

15. B

16. D

17. D

18. D

19. A

20. D

APPENDIX C

POST – POST TEST QUESTION

INSTRUCTION: Answer the following questions by tick (√) /circle the correct answers from option A-D.

Sex: Male () Female()

(1.) The lifespan of a cell consist of_____ period from the time the cell is formed to the time it undergoes cell division.

(a) 3

(B) 4

(c) 2

(D) 5

(2.)_____ Terminate the life of a cell but often result in the formation of new cells?

(a) mitosis

(B) cell division

(C) DNA

(d) chromosome

(3.) The combine loop of DNA and protein is_____?

(a) histone

(b) nucleus

(C) nucleosome

(d) interphase

(4.) The end result of DNA packaging is called_____?

(a)Nucleus

(B) Chromosome

(C) Histone

(D) Protein

(5.) A cell enters into the cell cycle as 1 cell which exit as _____ cell

(a) 1

(b) 3

(c) 4

(d) 2

(6.) The somatic chromosome number of the organism is composed of two sets of chromosomes each set is termed as?

(a) Diploid(n)

(b) Diploid(2n)

(c) Haploid(n)

(d) Diploid(2n)

(7.) The somatic number of chromosomes in any normal sexually reproducing organism is also refer to as?

(a) Haploid(n)

(b) Diploid(n)

(c) Haploid(2n)

(d) Diploid(2n)

(8.) If a cell begins with 50 chromosome, after the completion of all the mitotic events, each of the new cell will have _____ chromosome?

(a) 25

(b) 50

(c) 100

(d) 200

(9.) Mitosis results in the formation of new cell called?

(a) Mother cell

(b) Father cell

(c) Brother cell

(d) Daughter cell

(10.) The life cycle of the cell begins at _____ stage ?

(a) Interphase

(b) Metaphase

(c) Anaphase

(d) Telophase

(11.) During which stage of Mitosis do the centromere split in to two half ?

(a) Telophase

(b) Interphase

(c) Anaphase

(d) Metaphase

(12.) The cell spends most of its time at _____ ?

(a) Anaphase

(b) Mitosis

(c) Metaphase

(d) Interphase

(13.) _____ Is the beginning stage of mitosis?

(a) Interphase

(b) Anaphase

(c) metaphase

(d) Prophase

(14.) During what stage of mitosis is the paired chromatids aligning in the center?

(a) Metaphase

(b)telophase

(c)anaphase

(d)prophase

(15.) What is the correct order of the stages in Mitosis 1-Metaphase, 2-Telophase, 3-Anaphase, 4-prophase?

(a.)4,1,2,3

(b)2,3,1,4

(c) 1,2,3,4

(d) 4,1,3,2

(16.) At mitosis nucleus disappear at _____ and re appear at _____ stage?

(a) Prophase, Telophase

(b) Metaphase, Telophase

(c) Prophase, Anaphase

(d) Metaphase, Prophase

(17.) mitosis is divided into_____ phase

(a)4

(b) 5

(c) 6

(d)7.

(18.) In Mitosis_____ and _____ have opposite process occurring ?

(a) Prophase and Telophase

(b) Metaphase and Anaphase

(c) prophase and metaphase

(d)Metaphase and Telophase

(19.) At what phase of mitosis do the parent cell divided into two identical daughter cell ?

- (a) prophase
- (b) Telophase
- (c) Metaphase
- (d) Anaphase

(20.) in Which of the following phase would you find DNA being replicated?

- (a) Interphase
- (b)Prophase
- (c) Metaphase
- (d) Telophase

POST- POST TEST ANSWER

- 1. C
- 2. B
- 3. C
- 4. B
- 5. D
- 6. A
- 7. D
- 8. B
- 9. D
- 10. A
- 11. C
- 12. D
- 13. D
- 14. A
- 15. D
- 16. B
- 17. A
- 18. A
- 19. B
- 20. D

APPENDIX D

LESSON PLAN FOR CONTROL GROUP

School:	Sir Ahamadu Bello secondary school Maitunbi
Class:	SS2
Date:	23/09/19
Time:	11:00 – 12: 00 am
Duration:	1 hour
No of pupils:	40
Topic:	Cell division
Subtopic:	Mitosis

Instructional Materials: No instructional material

Previous Knowledge – The students have been taught cell division and types.

Behavioural Objectives – At the end of the lesson the student should be able to;

- 1, Describe DNA
- 2, Define mitosis
- 3, List the stages of mitosis
- 4, Explain at least 3 stages of mitosis

Introduction: The teacher introduce the lesson by asking the student

1. what is cell division
2. If they have ever wonder
 - How your wound got healed?
 - How your nail grow from the last time you cut it?
 - How you got a lot bigger than you were 5 years ago?

What do these things have in common?

Presentation: The teacher introduced the lesson according to the following steps below

Step 1 The teacher describes what DNA stands for

DNA is a genetic material that is inside all living organisms. It contains all the information to make us what we are today. DNA is made up of 4 Nitrogenous bases Adenine, Thymine, Guanine and Cytosine. A =T , G=C. In order to make new cells you need the same DNA in those new cells. DNA are tightly packaged into chromosomes.

Step 2. The teacher defines Mitosis

Mitosis is a type of cell division, which takes place during plant and animal growth. At the end of which the chromosome number of parent and daughter cells are usually the same. The production of new cells comes as a result of multiplication of the existing number of cells at each cell generation. The number of cells doubles at the end of each cell division cycle.

Step 3. The teacher lists the stages of cell division as follows

- a. Interphase
- b. Prophase
- c. Metaphase
- d. Anaphase
- e. Telophase

Step 4. The teacher explains the different stages of Mitosis

a. Interphase – before the onset of cell division, the nucleus is large and the content is dense and granular. The cell is said to be at the interphase.

b. Prophase Stage – The beginning phase, The chromosomes are first seen as threads which are thin and tangled together, spindle fibers emerge from the centrioles, nuclear envelope breaks down or nucleus is still there, centrosome moves toward opposite poles.

c. Metaphase Stage- the nuclear content progressively loses water and chromosomes become shorter and thicker, each chromosome shows quite clearly its two chromatids at this stage. The nuclear envelope disintegrates and the chromosomes lie freely in the center of the cytoplasm.

d. Anaphase Stage – the centromere of each chromosome divides lengthwise, moving to opposite side of the cell, moving towards the pole of the cell. The chromosomes are not moving by themselves, they actually have something called spindle. The spindles are fibers that help move chromosomes.

e. Telophase Stage- the last stage of Mitosis. By this time the daughter chromosomes are at each pole which are exactly the same in number and morphology as the somatic chromosome that the parent cell started with. They lose their definite structure, they become granular with new nuclear membrane, hence two new cells result from one parent cell.

Evaluation:

The teacher evaluates the student by asking them some questions to see the extent to which the behavioural objectives have been achieved.

a. What do you understand by DNA

b. What do you understand by Mitosis

c. Lists the phases of mitosis

d. Explain at least two phases of Mitosis

summary:

The teacher summarizes the lesson by briefly describing the different phases involved in mitosis

conclusion:

The teacher concludes the lesson by giving the students assignment to draw the phases of mitosis

APPENDIX E

LESSON PLAN FOR EXPERIMENTAL GROUP

School:	Bosso secondary school
Class:	SS2
Date:	24/09/19
Time:	9.00am – 10.00am
Duration:	1 hour
No of pupil:	45
Topic:	Cell division
Subtopic:	Mitosis
Instructional Materials –	straw tape DNA helix and mitosis Chart
Previous Knowledge –	The students have been taught cell division and types.
Behavioural Objectives –	At the end of the lesson the student should be able to; <ol style="list-style-type: none">1, Describe DNA2, Define mitosis3, List the stages of mitosis4, Explain at least 3 stages of mitosis
Introduction:	The teacher introduce the lesson by asking the student <ol style="list-style-type: none">1. What is cell division2. If they have ever wonder<ul style="list-style-type: none">-How your wound got healed?-How your nail grow from the last time you cut it?-How you got a lot bigger than you were 5 years ago?

What does this thing have in common?

Presentation: The teacher introduced the lesson according to the following steps below

Step 1 The teacher describe what DNA stands for by the means if a DNA model

DNA is a genetic material that is inside all living organisms. It contains all the information to make us what we are today. DNA is made up of 4 Nitrogenous bases Adenin, Thymine, Gunine and Cytosine. A =T , G = C. in order to make new cell you need the same DNA in those new cell. DNA are tightly package into chromosomes.

Step 2. The teacher defines mitosis by means of a chart

Mitosis is a type of cell division, which take place during plant and animals growth. At the end of which the chromosome number of parent and daughter cells are usually the same. The production of new cell comes as a result of multiplication of the existing number cells at each cell generation. The number of cells doubles at the end of each cell division cycle.

Step 3. The teacher through the chart then list the stages of cell division as follows;

a. Interphase

b. Prophase

c. Metaphase

d. Anaphase

e. Telophase

step 4. The teacher uses the improvised instructional material which is a chart of Mitosis to explain the different stages of Mitosis

- a. Interphase – before the onset of cell division, the nucleus is large and the content is dense and granular. The cell is said to be at the interphase.
- b. Prophase Stage – The beginning phase, The chromosomes are first seen as threads which are thin and tangled together, spindle fibers emerge from the centrioles, nuclear envelope breaks down or nucleus is still there, centrosome moves toward opposite poles.
- c. Metaphase Stage- the nuclear content progressively loses water and chromosomes become shorter and thicker, each chromosome shows quite clearly its two chromatids at this stage. The nuclear envelope disintegrates and the chromosomes lie freely in the center of the cytoplasm.
- d. Anaphase Stage – the centromere of each chromosome divides lengthwise, moving to opposite side of the cell, moving towards the pole of the cell. The chromosomes are not moving by themselves, they actually have something called spindle. The spindle are fibers that help move chromosomes.
- e. Telophase Stage- the last stage of Mitosis. By this time the daughter chromosomes are at each pole which are exactly the same in number and morphology as the somatic chromosome that the parent cell started with. They lose their definite structure, they become granular with new nuclear membrane, hence two new cells result from one parent cell.

Evaluation:

The teacher evaluates the student by asking them some questions to see the extent to which the behavioural objectives have been achieved.

- a. What do you understand by DNA

- b. What do u understand by Mitosis
- c. Lists the phases of mitosis
- d. Explain at least two phases of Mitosis

Summary: The teacher summarizes the lesson by briefly describing the different phases involved in mitosis

Conclusion: The teacher concludes the lesson by asking and guiding the students to construct the phases of mitosis

PHASES OF MITOSIS



Interphase



Prophase



Metaphase



Anaphase



Telophase

